eyes. Now the optical maser, or laser, is at work using its pure, powerful beam of light to carry messages, repair detached retinas, track satellites, and even study the nature of light itself.

CTA . . . CTA . . . Come In

See this Side

Suppose the planet earth wanted to send a powerful radio signal to the distant reaches of space to let any other sentient beings out there know that they are not alone. How could this be done?

First, earth would have to assume the extraterrestrials have a Charles Townes (page 89) and a well-developed electronics technology of their own in order to listen in. Then it would have to decide on the proper signal frequency for maximum range. The frequency is easy enough to determine, for a signal between 2,000 and 4,000 megacycles undergoes the least interference and distortion in space. The next requirement is a gigantic source of power to transmit the signal. Just to reach out a mere 10 million light-years would require an electric power output of about 400,000,000,000,000,000,000,000,000 watts (400 million billion billion). Since this is 100 thousand billion times as much power as the earth generates in a year, obviously we aren't ready to undertake such an ambitious project.

But others might be. With 100 billion stars in the local Milky Way galaxy alone, and with another 10 billion galaxies in the universe, it would be a crashing egocentrism to think otherwise. And it so happens that Soviet astronomers have been studying two distant sources of radio waves that just might meet these requirements.

Distant Voices: In a paper published in the Soviet Astronomicheskiy Zhurnal (Astronomy Journal), N.S. Kardashev of the Sternberg State Astronomical Institute suggests that two radio sources—known as CTA-21 and CTA-102 after their listing in the Cal Tech catalogue—may be trying to say something to someone. Kardashev notes that the radio signals seem to be coming from very small point sources. The spectrum of their radio emissions ranges from 1,000 to 3,000 megacycles—close to the ideal communications spectrum. And the signals appear strongest at 900 megacycles—again not far below the ideal. Unhappily, CTA-21 and CTA-102 cannot be seen through optical telescopes—but earth is small on the universal scale, and cannot be seen from any other star either.

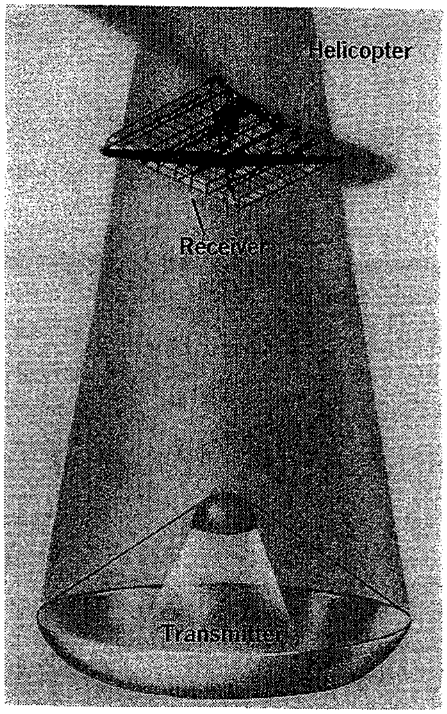
But could any civilization generate 400 million billion billion watts? At its present rate of growth, Kardashev points out, the earth will be producing such energy in 3,200 years. It is not outlandish to assume that some other civilization might be at that stage now.

A respected scientist, Kardashev is not saying that there are intelligent beings transmitting from CTA-21 and CTA-102. He cautiously asks for "a program of study . . . taking into account the peculiarities indicated here." Once before, in 1961, U.S. astronomers tuned in on two nearby stars in an attempt to discern an intelligible pattern of signals. No pattern appeared. It may be time to listen again.

Flying on the Beam

The 6-foot-long flying machine had no engine, no batteries, not so much as a rubber band to give it power. Yet when a technician threw a switch nearby, the whole contraption rose into the air and like a helicopter hovered magically there for ten minutes.

And indeed the demonstration, held last week at Raytheon Co.'s Burlington, Mass., plant, was as close as aviation has yet come to magic. The contraption was using electrical power, beamed from an antenna on the ground—the first time this has been done effectively.



Raytheon copter: No visible support

What happened was this: the antenna on the ground sent high-energy radio waves straight up. The waves struck the receiving antenna on the bottom of the flying platform, where thousands of small diodes converted them into electrical current. The current drove a motor that set the blades spinning. Then conventional aerodynamic lift took over.

Raytheon developed the rig for the U.S. Air Force, which is hoping to use more powerful models as the first permanent air-borne weather stations.